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LAUNCH KIT

November 2017

VV11

MOHAMMED VI - A satellite

esa

ThalesAlenia Space
a Thales / Leonardo company

MOHAMMED VI - A SATELLITE

AIRBUS DEFENCE & SPACE

cnes

FLIGHT VV11: VEGA TO LAUNCH AN EARTH OBSERVATION SATELLITE FOR THE KINGDOM OF MOROCCO

For its 10th launch of the year, and the 11th Vega mission since this launcher began its career at the Guiana Space Center in 2012, Arianespace will orbit the MOHAMMED VI - A. satellite. This Earth observation satellite for the Kingdom of Morocco was developed by a consortium comprising Thales Alenia Space as system prime contractor and Airbus as co-prime.

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Flight VV11 marks the eighth Earth observation mission for Vega, a versatile light launcher.

MOHAMMED VI - A satellite

The **MOHAMMED VI – A** satellite is an Earth observation satellite built for the Kingdom of Morocco by Thales Alenia Space as system prime contractor and Airbus as co-prime.

The **MOHAMMED VI – A** satellite will be in particular used for mapping and land surveying activities, regional development, agricultural monitoring, the prevention and management of natural disasters, monitoring changes in the environment and desertification, as well as border and coastal surveillance.

A three-axis stabilized satellite, the **MOHAMMED VI – A** satellite will weigh approximately 1,110 kg. at launch.

Thales Alenia Space, as system prime contractor, supplied the payload, including the optical instrument, the image transmission subsystem, and the ground segment for image processing and production. Airbus, as satellite prime contractor, was in charge of its integration, as well as supplying the platform and the ground segment for mission planning and satellite control.

The **MOHAMMED VI – A** satellite is the 150th satellite built by Thales Alenia Space to be launched by Arianespace, which has 15 more satellites from this manufacturer in its order book.

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MISSION DESCRIPTION

The 11th Arianespace Vega launch from the Guiana Space Center (CSG) will place the MOHAMMED VI - A satellite into a Sun-synchronous orbit (SSO).
The launcher will be carrying a total payload of approximately 1,190 kg.

The launch will be performed from the Vega Launch Complex (SLV) in Kourou, French Guiana.

DATE AND TIME

Liftoff is scheduled for **Tuesday, November 7, 2017**, at exactly:

> 8:42:31 p.m., in Washington D.C.
> 10:42:31 p.m., local time in French Guiana
> 01:42:31, Universal Time (UTC), on November 8
> 1:42:31 a.m., in Rabat, on November 8
> 2:42:31 a.m., in Paris, on November 8

MISSION DURATION

The nominal mission duration (from liftoff to separation of the satellite) is:
55 minutes, 33 seconds.

TARGETED ORBIT FOR THE MOHAMMED VI - A SATELLITE

Sun-synchronous orbit (SSO)

THE LAUNCH AT A GLANCE

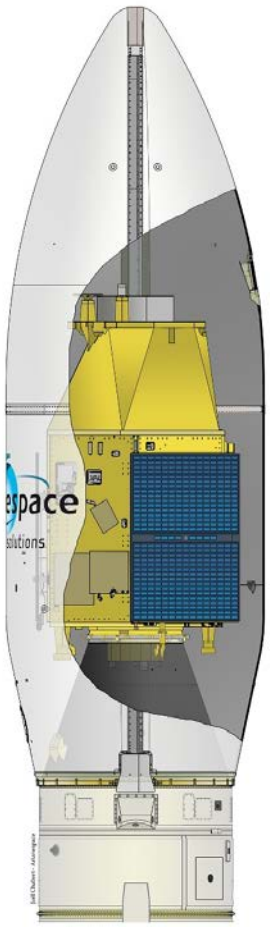
Following liftoff from the Guiana Space Center, the powered phase of Vega's first three stages will last six minutes and 35 seconds. After this first phase, the launcher's third stage will separate from the upper composite, which includes the AVUM upper stage, a payload adapter and the satellite. The lower three stages will fall back into the sea.

The AVUM upper stage will ignite its engine for the first time, operating for about seven minutes, followed by a ballistic phase lasting approximately 37 minutes. The AVUM stage will then reignite its engine for about one minute and 50 seconds, prior to releasing the MOHAMMED VI – A satellite about one minute and a half after the engine is shut down.

The MOHAMMED VI – A satellite will be released 55 minutes and 33 seconds after liftoff.

VEGA PAYLOAD CONFIGURATION

> Payload: the MOHAMMED VI - A satellite
> Weight at liftoff: 1,110 kg.
> Vega Payload Adaptor (PLA)



THE VEGA LAUNCHER

ELV, the production prime contractor, delivers the Vega launcher to Arianespace.

Payload fairing
(RUAG Space)

Payload adaptor
(Airbus Spain)

Integration & testing
(Avio)
AVUM

Production, integration & testing
(Avio)
ZEFIRO-9

Production, integration & testing
(Avio)
ZEFIRO-23

Integration & testing
(Avio)
P80

AVUM structure
(Airbus)

AVUM engine
(KB Yuzhnoye)

Interstage - 2/3
(Rheinmetall)

Interstage - 1/2
(Airbus Netherlands)

P80 engine
(Europropulsion)

Interstage - 0/1
(S.A.B.C.A)

P80 nozzle
(ArianeGroup)

Thrust vector control system (P80, Zefiro 9, Zefiro-23 & AVUM)
S.A.B.C.A

Igniters (P80, Zefiro-9 & Zefiro-23)
APP

Avionics
Thales, IN-SNEC, Selex Avionica, CRISA, RUAG Space, SAFT

LAUNCH CAMPAIGN:
VEGA – THE MOHAMMED VI – A SATELLITE

SATELLITE AND LAUNCH VEHICLE CAMPAIGN TIMETABLE

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
September 20, 2017		Campaign start review - Transfer of P80 stage
September 26, 2017		
September 22, 2017	Arrival in French Guiana of the **MOHAMMED VI – A** satellite at Felix Eboue Airport (Cayenne)	
September 23, 2017	Transfer of the **MOHAMMED VI – A** satellite to S3B	
September 26, 2017		Interstage 1/2 integration
September 27, 2017		Z23 integration
October 2, 2017		Z9 integration
October 6, 2017		AVUM integration
October 9, 2017	Start of electrical checks	
October 16, 2017		Synthesis control test
October 17 and 18, 2017	Fueling operations of the **MOHAMMED VI – A** satellite	
October 20, 2017	Integration of the **MOHAMMED VI – A** satellite on the payload adaptor	
October 23, 2017	The assembled payload is encapsulated in Vega's payload fairing	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL TIMETABLE

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Thursday, October 26, 2017	Transfer of upper composite from S3B to SLV (Vega Launch Site) Upper composite integration on the launcher	
From Monday, October 30 to Thursday, November 2, 2017		Fueling operations for AVUM and RACS (Roll and Attitude Control Subsystem)
Friday, November 3, 2017		AVUM final preparation and rehearsal
Saturday, November 4, 2017		Arming of launch vehicle and fairing
Monday, November 6, 2017		Launch readiness review (RAL), final preparation of launcher and final inspection of the fairing
Tuesday, November 7, 2017		Final launch countdown

COUNTDOWN AND FLIGHT SEQUENCE

The countdown comprises all final preparation steps for the launcher, the satellite and the launch site, including the steps leading up to authorization of P80 first-stage ignition.

TIME	EVENT
- 09 h 10 min	Start of final countdown
- 06 h 00 min	Activation of Multi-Functional Unit (MFU)
- 05 h 40 min	Activation of Inertial Reference System (IRS)
- 05 h 40 min	Activation of telemetry
- 05 h 10 min	Activation of Safeguard Master Unit (SMU)
- 04 h 50 min	Removal of safety devices
- 04 h 40 min	Activation of onboard computer and loading of flight program
- 04 h 30 min	IRS alignment and checks
- 03 h 15 min	Mobile gantry withdrawal (45 min.)
- 02 h 25 min	IRS alignment and checks after withdrawal of gantry
- 01 h 15 min	Activation of the telemetry transmitter after withdrawal of gantry
- 01 h 15 min	Activation of transponders and receptors
- 00 h 50 min	Launcher system ready
- 00 h 10 min	Final weather report prior to launch
- 00 h 04 min	Start of synchronized sequence
T-O	**00 s LIFTOFF**
+ 00 h 01 min 57 s	1st stage (P80) separation
+ 00 h 01 min 57 s	2nd stage (Zefiro-23) ignition
+ 00 h 03 min 40 s	2nd stage (Zefiro-23) separation
+ 00 h 03 min 52 s	3rd stage (Zefiro-9) ignition
+ 00 h 03 min 57 s	Fairing separation
+ 00 h 06 min 34 s	3rd stage (Zefiro-9) separation
+ 00 h 08 min 03 s	1st ignition of AVUM
+ 00 h 15 min 48 s	1st cut-off of AVUM
+ 00 h 52 min 06 s	2nd ignition of AVUM
+ 00 h 53 min 57 s	2nd cut-off of AVUM
+ 00 h 55 min 33 s	Separation of **the MOHAMMED VI - A satellite**
+ 01 h 47 min 44 s	3rd ignition of AVUM
+ 01 h 49 min 02 s	3rd cut-off of AVUM

ARIANESPACE AND THE GUIANA SPACE CENTER

ARIANESPACE, THE WORLD'S FIRST LAUNCH SERVICES COMPANY

Arianespace was founded in 1980 as the world's first launch services & solutions company. Arianespace is a subsidiary of ArianeGroup, which holds 74% of its share capital; the balance is held by 17 other shareholders from the European launcher industry. Since the outset, Arianespace has signed over 530 launch contracts and launched 550+ satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace.

The company posted sales of more than 1.4 billion euros in 2016.

The company's activities are worldwide, with the headquarters in Evry, France (near Paris); the Guiana Space Center in French Guiana, where the Ariane, Soyuz and Vega launch pads are located; and offices in Washington, D.C., Tokyo and Singapore. Arianespace offers launch services to satellite operators from around the world, including private companies and government agencies. These services call on three launch vehicles:

> The Ariane 5 heavy-lift launcher, operated from the Guiana Space Center in French Guiana.

> The Soyuz medium-lift launcher, currently in operation at the Guiana Space Center and the Baikonur Cosmodrome in Kazakhstan.

> The Vega light-lift launcher, also operated from the Guiana Space Center.

Building on its complete family of launchers, Arianespace has won over half of the commercial launch contracts up for bid worldwide in the past two years. Arianespace now has a backlog of more than 700 satellites to be launched.

THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For more than 40 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches. It comprises primarily the following:

> The CNES/CSG technical center, including various resources and facilities that are critical to launch base operations, such as radars, the telecom network, weather station, receiving sites for launcher telemetry, etc.

> Payload processing facilities (ECPU), in particular, the S5 facility.

> Ariane, Soyuz and Vega launch complexes, comprising the launch zones and launcher integration buildings.

> Various industrial facilities, including those operated by Regulus, Europropulsion, Air Liquide Spatial Guyane and ArianeGroup – all participating in the production of Ariane 5 components. A total of 40 European manufacturers and local companies are involved in launcher operations.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), the French space agency CNES (Centre National d'Etudes Spatiales) and Arianespace. ESA is responsible for the Ariane, Soyuz and Vega development programs. Once these launch systems are qualified, ESA transfers responsibility to Arianespace as the operator. ESA has helped change the role of the Guiana Space Center, in particular by funding the construction of the launch complexes, payload processing buildings and associated facilities. Initially used for France's space program, the Guiana Space Center has evolved into Europe's own Spaceport, according to the terms of an agreement between ESA and the French government. To ensure that the Spaceport is available for its programs, ESA takes charge of the lion's share of the CNES/CSG fixed expenses, and also helps finance the fixed costs for the ELA launch complexes.

CNES has several main responsibilities at the Guiana Space Center. It designs all infrastructure and, on behalf of the French government, is responsible for safety and security. It provides the resources needed to prepare the satellites and launchers for missions. Whether during tests or actual launches, CNES is also responsible for overall coordination of operations and it collects and processes all data transmitted from the launcher via a network of receiving stations to track Ariane, Soyuz and Vega rockets throughout their trajectories.

ARIANESPACE IN FRENCH GUIANA

In French Guiana, Arianespace is the contracting authority in charge of operating the family of three launchers: Ariane, Soyuz and Vega.

For Vega, Arianespace supervises the integration and inspection of the launcher constructed by ELV/Avio, the production prime contractor. At the same time, Arianespace coordinates the preparation of satellites in the payload preparation facility (EPCU) operated by CNES/CSG, handles the integration of satellites and preparation of the payload composite up to its transfer on the launcher to

the Vega launch zone (ZLV), and also works with ELV/Avio teams in charge of the launcher to conduct the final countdown and launch from Launch Control Center No. 3 (CDL3).

Arianespace deploys a top-flight team and technical facilities to get launchers and satellites ready for launch. Building on this unrivalled expertise and outstanding facilities in French Guiana, Arianespace is the undisputed benchmark in the global launch services market.